

REMARKS

On page 2 of the Office Action, the Examiner rejected claims 50-57, 59-67, and 69 under 35 U.S.C. §101 as being directed to non-statutory subject matter.

The Examiner asserts that these claims are merely directed to the act of calculating because the positions of teeth are merely numerical values and do not represent a real world object.

However, the positions of teeth and the finite analysis of an orthodontic treatment based on these positions are real world objects. As acknowledged by the Federal Circuit in *State Street Bank & Trust Co. v. Signature Financial Group Inc.*, 149 F. 3d 1368, 47 USPQ2d 1596 (Fed. Cir. 1998), "the mere fact that a claimed invention involves inputting numbers, calculating numbers, outputting numbers and storing numbers, in and of itself, would not render it nonstatutory." Instead, as also indicated by Section 2106 of the MPEP, the invention is patentable if it produces a useful, concrete and tangible result.

The invention covered by the present claims does produce a useful, concrete and tangible result. These claims are directed to the transformation of teeth

position input data into a new and useful output analysis of an orthodontic treatment to move the teeth between these positions. Taking claim 50 as an example, the original positions of a patient's teeth are stored in memory, the desired final positions of the patient's teeth are stored in the memory, a finite element analysis is performed based on an orthodontic treatment and a movement of the patient's teeth between the stored original and final positions, and a computer generated output that is based on the finite element analysis is provided.

Accordingly, applicants are not attempting to patent mere calculations as asserted by the Examiner. Instead, claim 50 involves the real world object of transforming data regarding teeth positions and orthodontic treatment into a very useful, concrete and tangible output concerning an orthodontic treatment. Therefore, the claimed invention is directed to statutory subject matter.

As indicated by Section 2106 of the MPEP, the practical application (real world object) for the claimed invention should preferably, although not necessarily, be disclosed in the application itself. The present

application discloses a practical application for the claimed invention. For example, the present application discloses that the claimed invention is useful in providing orthodontic treatment.

It cannot be doubted that the orthodontic treatment resulting from application of the present invention is highly valuable to the orthodontist as well as to the patient.

Accordingly, because the present invention is highly practical, it produces a "useful, concrete and tangible result." Therefore, again, the claimed invention is directed to statutory subject matter.

Section 2106 of the MPEP gives several examples illustrating claimed inventions that have a practical application because they produce useful, concrete, and tangible results. One example involves transforming input data representing discrete dollar amounts into an output representing a final share price. This data transformation was found to constitute a practical application producing a useful, concrete and tangible result. Similarly, the present claims involve transforming input data into useful a output.

Therefore, according to this example, the claimed invention is directed to statutory subject matter.

Section 2106 of the MPEP also states that the plain and unambiguous meaning of section 101 is that any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if it meets the requirements for patentability, and further states that the subject matter that courts have found to be outside the statutory categories of invention is limited to abstract ideas, laws of nature, and natural phenomena.

The Examiner does not assert that the claimed invention is a law of nature or a natural phenomena. However, the Examiner appears to suggest that the invention presently being claimed is abstract because it is directed to merely making calculations. But, as indicated above, the input data to the claimed method is manipulated in a very concrete way to produce a very tangible result. In claim 50, for example, beginning and final teeth positions are used by a finite element analysis along with an orthodontic treatment to produce an output based on that finite element analysis. All

data manipulations are concrete, and the result is a concrete output that is very useful to both the orthodontist and the patient.

Finally, the Examiner's attention is directed to Ex Parte Donner, 53 USPQ2d 1699, (Bd Pat App & Inter, 1999), in which the Board considered a claim to a computer implemented method of storing and analyzing input data so as to produce an output in the form of an estimated value. The Board held that this transformation of data produced a useful, concrete and tangible result.

Similarly, transforming data regarding teeth positions and orthodontic treatment into an output produces a useful, concrete and tangible result.

For all of the reasons given above, the claimed invention is directed to statutory subject matter.

On page 2 of the Office Action, the Examiner rejected claim 69 under 35 U.S.C. §112, second paragraph as being indefinite. Accordingly, claim 69 has been amended to overcome this rejection.

On page 3 of the Office Action, the Examiner rejected claims 50-53, 58, and 59 under 35 U.S.C. §103(a) as being unpatentable over the Chishti '511 patent in view of the Chishti '893 patent.

According to independent claim 50, the original positions of a patient's teeth are stored in memory, the desired final positions of the patient's teeth are stored in the memory, a finite element analysis is performed based on the orthodontic treatment and a movement of the patient's teeth between only the stored original and final positions, and a computer generated output that is based on the finite element analysis is provided.

As the Examiner has recognized, the Chishti '511 patent does not disclose performing a finite element analysis based on a movement of the patient's teeth between only stored original and final positions. Therefore, the Examiner has cited the Chishti '893 patent.

The Chishti '893 patent, like the Chishti '511 patent, discloses positioning a patient's teeth using a plurality of intermediate positions between the original and final positions of the patient's teeth. The Examiner, however, asserts that the gap between independent claim 50 and the Chishti '511 patent is filled in by the Chishti '893 patent because the Chishti '893 patent discloses at column 5, lines 1-7 that, in those cases where patients' teeth are responding very

quickly, one or more intermediate appliances may be skipped so that the number of appliances is reduced below the number determined at the outset.

This portion of the Chishti '893 patent does not disclose or suggest that all intermediate appliances can be eliminated and that a single final appliance can be used to move a patient's teeth from their original positions to their final positions. Indeed, the Chishti '893 patent teaches that at least one intermediate appliance in addition to an initial appliance and a final appliance are used. For example, the Chishti '893 patent in column 3, lines 31-45 states that at least a first (initial) appliance repositions a patient's teeth from the initial tooth arrangement to a first intermediate arrangement, at least one intermediate appliance repositions the teeth from the first intermediate arrangement to one or more successive intermediate arrangements, and a final appliance repositions the teeth from the last intermediate arrangement to the desired final tooth arrangement.

Therefore, the Chishti '893 patent does not suggest performing the finite element analysis disclosed in the Chishti '511 patent based on a movement of the

patient's teeth between only the original and final positions.

The Examiner further asserts that one of ordinary skill in the art would be motivated in view of the Chishti '893 patent to eliminate all intermediate positions in order to reduce costs. However, whatever the motivation, the Chishti '893 patent does not suggest eliminating all intermediate positions. Moreover, the Chishti '893 patent does not suggest eliminating any intermediate positions in order to reduce costs. Instead, the Chishti '893 patent suggests only that intermediate positions can be eliminated in those cases where patients' teeth are responding very quickly.

The Examiner also asserts that the present application itself teaches the use of intermediate steps and that the present application does not attach any criticality to the elimination of intermediate steps. However, these assertions are immaterial to the issue of whether the combination of the Chishti '511 patent and the Chishti '893 patent would have suggested the invention of independent claim 50 to one of ordinary skill in the art. Indeed, as shown above, the combination of the Chishti '511 patent and the Chishti

'893 patent would not have suggested the invention of independent claim 50 to one of ordinary skill in the art.

Because the combination of the Chishti '511 patent and the Chishti '893 patent would not have suggested the invention of independent claim 50 to one of ordinary skill in the art, independent claim 50 of the present application is not unpatentable over the Chishti '511 patent in view of the Chishti '893 patent.

Because independent claim 50 is not unpatentable over the Chishti '511 patent in view of the Chishti '893 patent, dependent claims 51-53, 58, and 59 are likewise not unpatentable over the Chishti '511 patent in view of the Chishti '893 patent.

On page 4 of the Office Action, the Examiner rejected claims 54-57 under 35 U.S.C. §103(a) as being unpatentable over the Chishti '511 patent in view of the Chishti '893 patent and further in view of the Chishti '310 application.

The Chishti '310 application discloses the use of intermediate positions and does not suggest performing a finite element analysis based on a movement of the patient's teeth between only original and final positions. Therefore, because, as pointed above, the

combination of the Chishti '511 patent and the Chishti '893 patent would not have suggested the invention of independent claim 50 to one of ordinary skill in the art, adding the Chishti '310 application to this combination does not advance the combination of the Chishti '511 patent and the Chishti '893 patent toward the invention of independent claim 50.

Accordingly, the combination of the Chishti '511 patent, the Chishti '893 patent, and the Chishti '310 application would not have suggested the invention of independent claim 50 to one of ordinary skill in the art. Thus, independent claim 50 is not unpatentable over the Chishti '511 patent in view of the Chishti '893 patent and further in view of the Chishti '310 application.

Because independent claim 50 is not unpatentable over the Chishti '511 patent in view of the Chishti '893 patent and further in view of the Chishti '310 application, dependent claims 54-57 cannot be unpatentable over the Chishti '511 patent in view of the Chishti '893 patent and further in view of the Chishti '310 application.

On page 4 of the Office Action, the Examiner rejected claims 60, 61, and 66-69 under 35 U.S.C. §103(a) as being unpatentable over the Chishti '511 patent in view of the Murakami patent.

Independent claim 60 recites that a finite element analysis is performed based on contact pairs between orthodontic appliances or between orthodontic appliances and teeth to be applied during the orthodontic treatment.

As the Examiner has recognized, there is no disclosure in the Chishti '511 patent of performing a finite element analysis based on contact pairs between orthodontic appliances or between orthodontic appliances and teeth to be applied during the orthodontic treatment. Indeed, the Chishti '511 patent does not disclose contact pairs at all.

Therefore, the Examiner has relied on the Murakami patent.

The Examiner points to column 5, lines 42-55 of the Murakami patent for a disclosure of using contact pairs during a finite element analysis. This portion of the Murakami patent discloses that the stress distribution on and in an object is determined by first

detecting the pattern of the temperature variation on the surface of the actual object, by summing the principal stresses on the surface of the actual object, by entering the coordinates of the contact points, constraint conditions, and elastic constants which are necessary for a numerical analysis of the stresses in a model having the same shape as the actual object for which the principal stress sums have been found, by entering the coordinates of the points on which the external forces act, by entering the principal stress sums, by using a numerical analysis to find the principal stress sums when the external force is applied to certain of the free nodal points while one or two arbitrary nodes of the boundary are constrained, and by finding the correct value of the force acting on the nodal point of each constrained portion.

The Murakami patent does not define the nature of the contact points, and does not disclose any contact pairs even remotely similar to those recited in independent claim 60. Therefore, even the skilled artisan would not understand any combination of the Chishti '511 patent and the Murakami patent to suggest a modification of the finite element analysis disclosed in

the Chishti '511 patent so that the finite element analysis is performed based on contact pairs between orthodontic appliances or between orthodontic appliances and teeth.

Moreover, the Murakami patent does not express a pertinence to orthodontics nor to any area of dentistry. For this reason also, even the skilled artisan would not understand any combination of the Chishti '511 patent and the Murakami patent to suggest a modification of the finite element analysis disclosed in the Chishti '511 patent so that the finite element analysis is performed based on contact pairs between orthodontic appliances or between orthodontic appliances and teeth.

The Examiner asserts that the discussion of forces in the Murakami patent inherently suggests a consideration of the areas to which the forces are applied because it is well known that forces are applied to contact points. However, even if the Examiner's assertion were true, it does not help determine what the Murakami patent means by contact points.

Moreover, the Murakami patent is directed to the determination of a stress distribution in an elastic

body based measured temperature variations on the surface of the body. This determination is irrelevant to orthodontic treatments. Thus, such a patent would not have led even one skilled in the art to modify the disclosure of the Chishti '511 patent so as to produce the invention of independent claim 60.

Furthermore, the forces that are described in the Murakami patent are applied to free nodal points and are applied in order to find the sums of the principal stresses at the points located inside the surface of the actual object. Free nodal points do not suggest the contact pairs of independent claim 60 and, in fact, suggests just the opposite.

Accordingly, for all of the reasons give above, a combination of the Chishti '511 patent and the Murakami patent would not have suggested the invention of independent claim 60 to one of ordinary skill in the art.

Because a combination of the Chishti '511 patent and the Murakami patent would not have suggested the invention of independent claim 60 to one of ordinary skill in the art, independent claim 60 is not unpatentable over the Chishti '511 patent in view of the Murakami patent.

Because independent claim 60 of the present application is not unpatentable over the Chishti '511 patent in view of the Murakami patent, dependent claims 61 and 66-69 are likewise not unpatentable over the Chishti '511 patent in view of the Murakami patent.

On page 5 of the Office Action, the Examiner rejected claims 62-65 under 35 U.S.C. §103(a) as being unpatentable over the Chishti '511 patent in view of the Murakami patent and further in view of the Chishti '310 application.

As pointed above, the combination of the Chishti '511 patent and the Murakami patent would not have suggested to one of ordinary skill in the art the use of contact pairs as recited in independent claim 60. Moreover, the Chishti '310 application also does not disclose or suggest the use of contact pairs. Therefore, adding the Chishti '310 application to the combination of the Chishti '511 patent and the Murakami patent would not have suggested the invention of independent claim 60 to one of ordinary skill in the art.

Accordingly, independent claim 60 is not unpatentable over the Chishti '511 patent in view of the

Murakami patent and further in view of the Chishti '310 application.

Because independent claim 60 is not unpatentable over the Chishti '511 patent in view of the Murakami patent and further in view of the Chishti '310 application, dependent claims 62-65 cannot be unpatentable over the Chishti '511 patent in view of the Murakami patent and further in view of the Chishti '310 application.

On pages 5 and 6 of the Office Action, the Examiner rejected claims 70-102 under 35 U.S.C. §103(a) as being unpatentable over the Chishti '511 patent in view of the Chishti '310 application.

Independent claim 70 requires storing a proposed subset of a set of pre-existing orthodontic appliances according to a proposed orthodontic treatment, performing a finite element analysis based on the proposed orthodontic treatment, storing a new subset of the set of pre-existing orthodontic appliances if the finite element analysis indicates that the proposed orthodontic treatment produces undesired effects, and repeating the finite element analysis.

The Chishti '511 patent does not disclose storing a set of pre-existing appliances and testing subsets of the stored appliances with a finite element analysis in order to determine which subset will provide an effective orthodontic treatment. Instead, the Chishti '511 patent shows in Figure 2 that, if an initial aligner does not produce the desired result, a new aligner to be tested is calculated rather than retrieved from memory.

Accordingly, the Examiner relies on the Chishti '310 application, citing paragraph 0141 in particular.

The Chishti '310 application discloses that a polymeric appliance (shown in Figure 1C) may be used to reposition a patient's teeth, that no attachments, such as wires and brackets, are typically provided for holding the polymeric appliance in place over the teeth, and that in some cases, however, it may be necessary to provide individual attachments on the teeth within corresponding receptacles or apertures in the polymeric appliance so that the polymeric appliance can apply forces that would not be possible in the absence of such attachments.

To this end, paragraph 0141 of the Chishti '310 application discloses that conventional attachments are available in standard shapes and sizes, that these

attachments can be selected from a library of virtual appliances, and that the presence of virtual attachments ensures that the polymeric appliances fabricated for the patient's treatment plan will accommodate the corresponding physical attachments placed in the patient's mouth during treatment.

As can be seen, the Chishti '310 application likewise does not disclose or suggest storing a set of pre-existing appliances (attachments) and testing subsets of these appliances with a finite element analysis to determine which subset will provide an effective orthodontic treatment. Instead, the Chishti '310 application at most suggests choosing an attachment, designing an initial aligner to accommodate the attachment, and, if the initial aligner does not produce the desired result, designing a new aligner for testing rather than retrieving the new aligner from memory. The Chishti '310 application does not suggest that a new attachment is also tested along with the new aligner.

Accordingly, even if attachments are stored in memory, there is no suggestion to iteratively test these attachments by a finite element analysis. At most, the

Chishti '310 application suggests iteratively testing only aligners.

Accordingly, a combination of the Chishti '511 patent and the Chishti '310 application would not have suggested the invention of independent claim 70 to one of ordinary skill in the art.

Because neither the Chishti '511 patent nor the Chishti '310 application suggests invention of independent claim 70, independent claim 70 of the present application is not unpatentable over the Chishti '511 patent in view of the Chishti '310 application.

Independent claim 89 recites storing a set of orthodontic appliances, applying a subset of the stored set of orthodontic appliances to the patient's teeth according to one of first and second position models, and performing a finite element analysis based on the first position model, the second position model, and the applied subset of orthodontic appliances.

The Chishti '511 patent does not disclose or suggest that a set of appliances is stored and that a subset of stored appliances as applied to the patient's teeth is tested with a finite element analysis.

The Chishti '310 application patent also does disclose or suggest that a set of appliances is stored and that a subset of the stored appliances as applied to the patient's teeth is tested with a finite element analysis.

The Chishti '310 application does mention that attachments can be selected from a library. Such disclosure is not suggestive of storing the attachments in a memory and the selecting a subset of the stored attachments for processing by a finite elements analysis.

Because neither the Chishti '511 patent nor the Chishti '310 application suggests storing appliances in a memory and the selecting a subset of the stored appliances for processing by a finite elements analysis, independent claim 89 of the present application is not unpatentable over the Chishti '511 patent in view of the Chishti '310 application.

On page 7 of the Office Action, the Examiner rejected claims 50-102 on the grounds of double patenting. Accordingly, a terminal disclaimer is being filed herewith to overcome the double patenting rejection.

Application Serial
No. 10/777,840

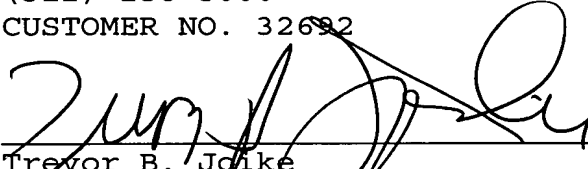
CONCLUSION

In view of the above, the claims of the present application patentably distinguish over the art applied by the Examiner. Accordingly, allowance of these claims and issuance of the present application are respectfully requested.

Respectfully submitted,

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August 23, 2006